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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/573,783

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Toru Onodera

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EXAMINER

LENIHAN, JEFFREY S

ART UNIT

PAPER NUMBER

4171

MAIL DATE

DELIVERY MODE

05/08/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/573,783	Applicant(s) ONODERA ET AL.	
	Examiner Jeffrey Lenihan	Art Unit 4171	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>11/02/2006, 10/24/2007, 12/14/2007</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

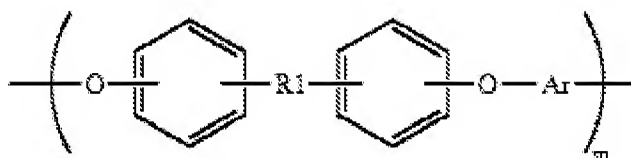
A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-13 rejected under 35 U.S.C. 102(b) as being anticipated by Ube Industries, WO/2002/091507, published on 11/14/2002. Hirano et al, US Patent No. 7258941, is a US patent granted on the National Phase entry of the corresponding PCT application, PCT/JP2002/004429, in the United States. The examiner notes for the record that Hirano has been used as an equivalent English translation for the purposes of examination.

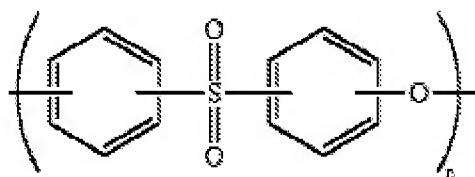
3. Regarding claims 1, 3-5, and 7; the applicant claims a block copolymer comprising a hydrophilic segment containing acid groups and a hydrophobic segment which contains no acid groups. The instant claim 3 requires that the acid group be a strong or super strong acid group. The instant claim 7 recites a polymer electrolyte comprising said block copolymer.

4. Hirano discloses a polyelectrolyte for a solid polymeric fuel cell, comprising an aromatic polyether sulfone block copolymer comprising a hydrophilic segment containing sulfonic acid groups and a hydrophobic segment having no sulfonic acid groups. The hydrophilic segment is disclosed to have the general structure



wherein R1 is either a carbonyl or sulfone, Ar represents a divalent aromatic group, and sulfonic acid groups are introduced to an aromatic ring selected from the group consisting of at least one of the aromatic rings bonded to R1, an aromatic ring of Ar, and combinations thereof. (US7258941, Claim 1). This corresponds to formula (1) of the instant claim 1. Hirano further specifies that a preferred embodiment for Ar is a biphenyl residue (Column 6, formula 3). The introduction of sulfonic acid groups in the combinations disclosed by Hirano onto a segment in which Ar is biphenyl yields formula (4) of the instant claim 5.

5. Claim 3 of US7258941 further specifies that the block copolymer having the hydrophilic segment shown above contains a hydrophobic segment having the structure



This corresponds to the formulae (2) and (3) of the instant claim 1 and 4, respectively.

6. Regarding the instant claim 2, Hirano discloses that weight ratio of the hydrophobic segment to whole aromatic block copolymer is preferably within the range

of 0.33 to 0.63 (Column 7, lines 46-50). The weight ratio of the cation exchange group-bearing hydrophilic segment to the hydrophobic segment would therefore fall within the range of 37:63 to 67:33, which overlaps with the range of 5:95 to 40:60 disclosed in the instant claim.

7. Regarding claim 6, the applicant claims that the ion exchange capacity of the block copolymer is from 0.8 to 2.4 meq/g. Hirano specifies that the ion exchange capacity of block copolymers should be 0.8 to 2.5 mmol/g (Column 4, lines 44-46; US7258941 Claim 6).

8. Regarding claims 8 and 9, the applicant discloses an electrolyte membrane comprising the disclosed polymer electrolyte (Instant Claim 8), and a composite membrane comprising the claimed polymer electrolyte and a porous substrate (Instant Claim 9). Hirano discloses the casting of a film to form a membrane comprising the block copolymer taught in US7258941 (Column 11, lines 48-61), and further discloses that this membrane may be reinforced by fibers, a porous film, or the like (Column 11, lines 65-66).

9. Regarding claim 10, the applicant claims a catalyst composition comprising the disclosed electrolyte block copolymer. Hirano discloses the production of a membrane electrode by forming a gas diffusion electrode directly on the polyelectrolyte membrane. Said gas diffusion electrode is recited as having a catalyst such as platinum, or a carrier such as carbon having catalyst particles dispersed thereon (Column 12, lines 45-56).

10. Regarding claims 11-13, the applicant claims polymer electrolyte fuel cells comprising (a) a polymer electrolyte membrane (Instant Claim 11), (b) a composite

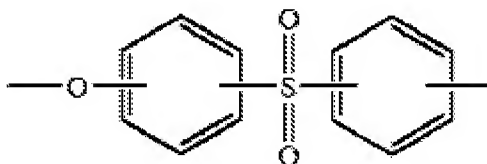
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membrane comprising a polymer electrolyte and a porous substrate (Instant Claim 12) and (c) a membrane comprising a polymer electrolyte and a catalyst (Instant Claim 13).

Example 4 of Hirano (Column 19, line 60 to Column 20, line 16) discloses the fabrication of a fuel cell by first casting a block copolymer membrane onto a platinum-loaded gas diffusion electrode; the membrane is dried and then allowed to absorb water to form an electrode. Block copolymer membranes are sandwiched between a pair of such electrodes, and the resulting electrode assembly was placed in a single cell to test power generation via a fuel cell test system.

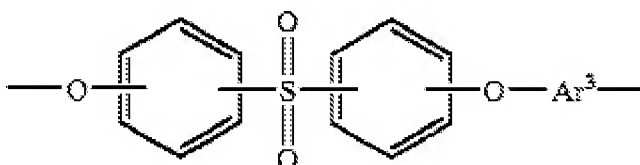
11. Claims 1 -10 are rejected under 35 U.S.C. 102(b) as being anticipated by Ube Industries, WO2003/046080, published on 06/05/2003. Kinouchi et al, US PG Pub. 2005/0069780, is the published patent application for the National Phase entry of the corresponding PCT application, PCT/JP02/12510, in the United States. The examiner notes for the record that Kinouchi has been used as an equivalent English translation of WO2003/046080 for the purposes of examination.

12. Regarding claims 1 and 3-6, Kinouchi discloses an aromatic polyether sulfone having a structural unit represented by the formula



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corresponding to formulae (2) of the instant claim 1 and (3) of the instant claim 4. The polyether sulfone also comprises a second structural unit, containing a cation exchange group, with the general formula



wherein Ar^3 represents a divalent aromatic group (§0023 and 0024; Reference Claim 3).

The cation exchange group is disclosed to preferably include a sulfonic acid group (§0046), as recited in the instant claim 3. Kinouchi discloses that sulfonic acid groups may be introduced to both the aromatic ring of Ar^3 (§0109), as well as the aromatic rings bonded to the electron attractive sulfone groups (§0111; reference claim 7). This second structure corresponds to formulae (1) and (4) of the instant claims 1 and 5, respectively.

13. Regarding claim 2, Kinouchi discloses that the weight fraction of the cation exchange group-bearing hydrophilic segment in the aromatic polyether sulfone block copolymer preferably falls within the range of 0.05 to 0.95 (§0120). The weight composition ratio of hydrophilic to hydrophobic segment would therefore range from 5:95 to 95:5, encompassing the range of 5:95 to 40:60 disclosed in the instant claim.

14. Regarding claim 6, Kinouchi discloses that the ion exchange capacity of the aromatic polyether sulfone is preferably 0.3 to 7 meq/g, and more preferably 0.4 to 7 meq/g (§0047). This range encompasses the range disclosed in the instant claim.

15. Regarding claims 7-10, Kinouchi teaches the production of an electrolyte composition via dissolving predetermined amounts of the disclosed aromatic polymer and a molten salt in a solvent followed by drying, or by immersing a molded article of the polymer in the molten salt to impregnate the aromatic polymer with the molten salt (§0183). Kinouchi further teaches the production of membranes via a process of dissolving the polymer and molten salt in a solvent, casting the solutions, and removing the solvent by drying (§0186). Molded articles prepared from this electrolyte may be reinforced with fibers, a porous film, or the like to form a composite membrane, and may also contain catalyst materials such as platinum (§0194).

Conclusion

16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Iwasaki et al, US Patent No. 5985477, discloses copolymers of sulfonated aromatic polyether sulfones comprising structural units similar to those disclosed in the current application in which sulfonic acid groups are introduced onto aromatic rings not adjacent to a sulfone group. Fuel cells comprising films of such polymers were evaluated based on current density versus voltage. Iwasaki does not specify the use of block copolymers. Yen et al, US Patent No. 5795496, discloses the use of sulfonated polymers comprising either an aromatic polyether ether ketone (PEEK) or poly(p-phenylene ether sulfone) (PES) as materials used in the preparation of electrolytic membranes in fuel cells. Copolymers comprising the two polymers are not disclosed. Terahara et al, US PG Pub. 20010041279 discloses block copolymers

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electrolytes comprising one or more blocks having sulfonic acid groups and one or more blocks having substantially no sulfonic acid groups. Ofer et al, US PG Pub.

20020045085 also discloses membranes comprising porous polymer substrates interpenetrated with ion conductive materials, such as sulfonated polyether sulfone polymers, which may be used in fuel cells.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey Lenihan whose telephone number is (571)270-5452. The examiner can normally be reached on Mon-Thurs: 7:30-5:00, every other Friday 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, D. Lawrence Tarazano can be reached on 571-272-1515. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/D. Lawrence Tarazano/
Supervisory Patent Examiner, Art Unit 4171

Jeffrey Lenihan
Examiner
Art Unit 4171

/JL/